Claims

1. A porous silica granule approximately spherical in shape, having a carbon concentration of less than 1 wt.-ppm, a pore volume of 0.5 cm^3 or less per 1 gram of the granules, a mean diameter of pores of 50 nm or less, a specific surface area of 100 m^2/g or less, and a bulk density of 0.7 g/cm^3 or higher.

2. A porous silica granule as claimed in Claim 1, wherein the water content thereof is a maximum of about 1% by weight.

3. A porous silica granule as claimed in Claim 1, wherein the particle diameter of the porous silica granule is in a range of from 50 to 800 μm.

4. A method for producing porous silica granules, comprising dispersing a fumed silica obtained by hydrolysis of a silicon compound into pure water to obtain a slurry having a solid concentration of from 50 to 80 % by weight; controlling the pH value of the slurry to a range of from 1 to 4; and, while stirring, drying the slurry until the water content thereof is a maximum of about 20% by supplying a heated dying gas to obtain the porous silica granules.

5. A method as claimed in Claim 4, wherein the drying gas is supplied to the slurry until the water content thereof is a maximum of about 1%.

6. A method as claimed in Claim 4, wherein the drying gas is heated to a temperature range of from 80 to 150 °C.

7. A method as claimed in Claim 4, wherein the particle diameter of the fumed silica is a maximum of about 4 μm or less.

8. A method as claimed in Claim 4, wherein the solid concentration of the slurry is in a range of from 60 to 70 % by weight, and the pH value is in a range of from 2 to 3

9. A method as claimed in Claim 4, wherein the rate of evaporating water by supplying heated gas is 50 g/hour or lower per 1 kg of the initial slurry.

10. A method as claimed in Claim 4, wherein the porous silica granules are classified in a classification step.

11. A method as claimed in Claim 10, wherein the particle diameter of the silica granules obtained by classification is in a range of from 180 to 500 μm

12. A method as claimed in Claim 4, wherein a silicon compound free from carbon atoms is used.

13. A method for producing porous silica granules, obtained by a sol-gel method comprising preparing a wet gel body by reacting high purity alkoxysilane with water; drying the resulting body and size-reducing it thereafter; and applying a purification treatment.

14. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 1, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

15. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 2, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

16. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 3, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

17. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim

4, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

18. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 5, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

19. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 6, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

20. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 7, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

21. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 8, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C

under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

22. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 9, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

23. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 10, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat

treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

24. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 11, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

25. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 12, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

26. A method for producing high purity synthetic quartz glass powder by using porous silica granules obtained by the production method as claimed in Claim 13, comprising

- a step of heat treatments, comprising performing a first heat treatment by heating said silica granules in a temperature range of from 150 to 300 °C under an oxygen-containing atmosphere, a second heat treatment of heating in a temperature range of from 600 to 1100 °C, and a third heat treatment in a temperature range of from 1100 to 1300 °C under an atmosphere containing hydrogen chloride; and

- a step of densification, comprising calcining the silica granules at a temperature not higher than 1500 °C under vacuum or in an atmosphere of gaseous hydrogen or gaseous helium.

27. A method as claimed in Claim 14, wherein the calcining is performed in the temperature range of from 1300 to 1500 °C.

28. Method as claimed in claim 14, wherein calcining comprises performing bubbling fluidization of said porous silica granules by supplying gaseous helium and calcining thereof in a temperature range of from 1300 to 1600 °C.

29. Method as claimed in Claim 28, wherein gaseous helium is supplied after it is heated to at least 600 °C.

30. Method claimed in Claim 28, wherein gaseous helium is circulated.

31. Method claimed in Claim 29, wherein gaseous helium is circulated.

32. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 13.

33. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 14.

34. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 27.

35. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 28.

36. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 29.

37. A method for producing high purity synthetic quartz glass, comprising fusing and vitrifying the high purity synthetic quartz glass powder obtained by the production method claimed in Claim 30.